Veterans Administration Hospital (44)

13000 Sayre Street, Los Angeles County

CONTENTS

Photographs provided by Brandow & Johnston Associates.

ROY G. JOHNSTON
Brandow & Johnston Associates
Los Angeles, Calif.

INTRODUCTION

The San Fernando Veterans Administration Hospital is located adjacent to the community of Sylmar in the northeastern section of the San Fernando Valley, approximately 5 miles from the epicenter of the February 9, 1971, earthquake. It is situated in the foothills of the San Gabriel Mountains on a 100-acre wooded reservation (figs. 1 and 2).

On March 1, 1926, the hospital opened as a tuberculosis hospital. It was redesignated as a general hospital on July 1, 1963. As of February 9, 1971, the hospital consisted of 45 separate buildings and six support facilities, which constituted a 420-bed general medical hospital and 36-bed nursing home care unit.

Table 1 shows the various structural classifications of buildings at this location. Table 2 is a summary of postearthquake inspection observations of buildings and ancillary structures which comprised the existing structural contingent of the hospital complex as of February 9, 1971. Also included in table 2 is the year in which each unit was constructed, as far as can be ascertained from readily available extant documents. The unit identification numbers, which correspond to those shown on the map in figure 1, are those that were appropriated originally and have been perpetuated by the Veterans Administration. Discontinuity in the consecutive numbering system signifies that certain units were removed, destroyed, sold, or otherwise disposed of prior to February 9, 1971. The titles, which may or may not be identical to the original titles, are those which were most recently employed by the hospital administration. Through the years, some of the facilities have been reassigned occupancy classifications nominally different from those originally assigned.

In the interest of avoiding confusion, only the unit identification numbers will be used in reference to particular structures throughout this report.

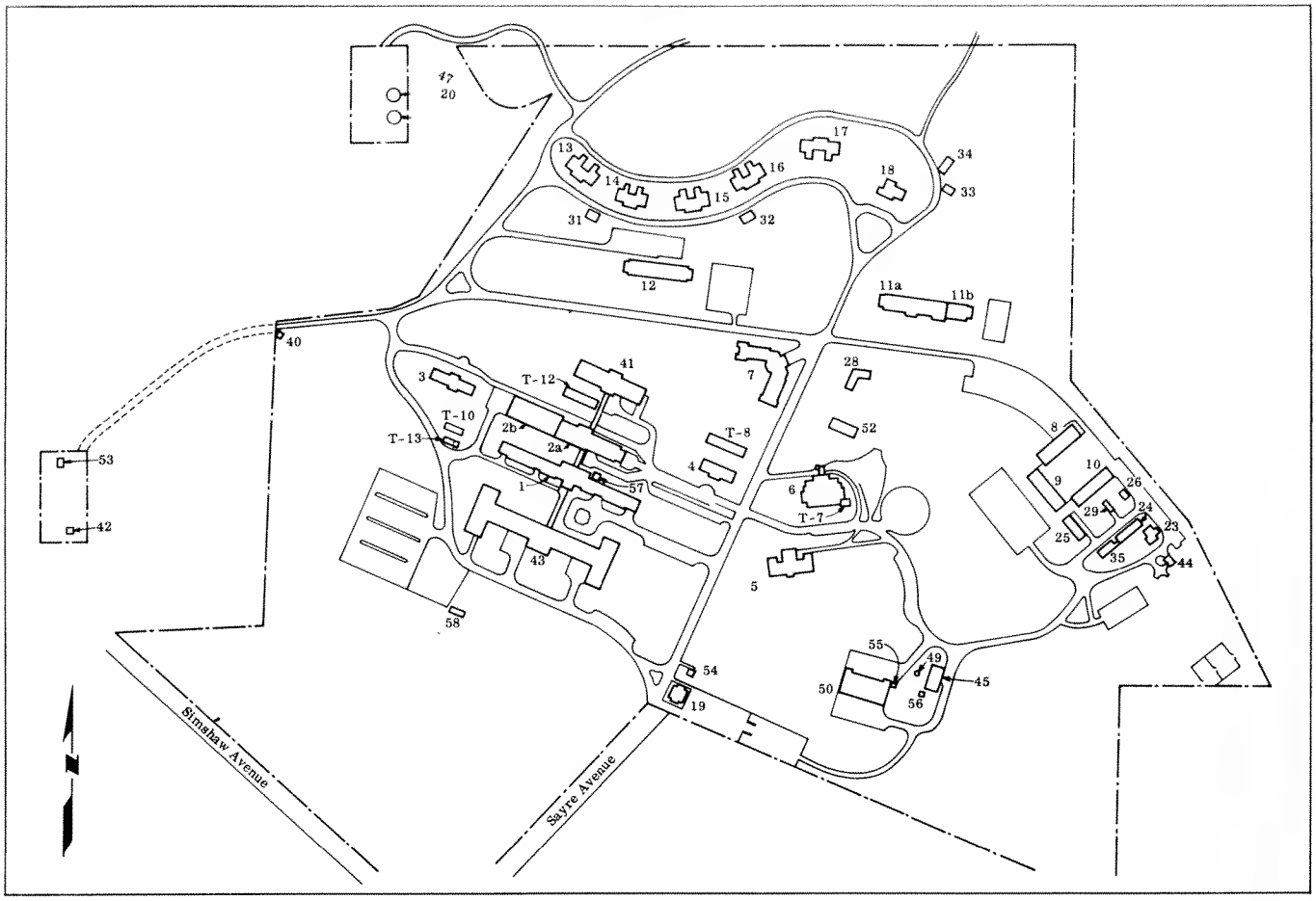

Figure 1.—Map of Veterans Administration Hospital. Building unit identification numbers correspond to those shown in table 2.

Figure 2.—Veterans Administration Hospital. View toward southeast from adjacent hillside with unit 43 in center.

Table 1.—Types of combined structural systems of buildings

Structural classification	Vertical load-carrying system	Lateral force-resisting system
Type I.....	Reinforced concrete frame.	Reinforced concrete diaphragm(s) and reinforced concrete frame with unreinforced hollow clay tile shear walls.
Type II.....	Reinforced concrete frame and reinforced concrete bearing walls.	Reinforced concrete diaphragm(s) and reinforced concrete shear walls.
Type III....	Wood frame and unreinforced hollow clay tile bearing walls.	Wood diaphragm(s) and unreinforced hollow clay tile shear walls.
Type IV....	Wood frame.....	Wood diaphragm and plaster on wood stud shear walls.
Type V.....	Metal frame.....	Metal diaphragm and metal bracing.

NOTE.—The structural classification types in this report are not equivalent to and should not be identified with standard building code nomenclature regarding building types.

Table 2.—Summary of inspection observations

Unit identification number	Year constructed	Structural classification type	Inspection observations
1	1925	I	Building had totally collapsed and debris has been removed (fig. 3).
2(a)	1925	I	Building had totally collapsed and debris has been removed (figs. 4, 5, and 6).
2(b)	1950	II	Frame was essentially intact. Exterior walls had diagonal hairline cracks. Chimneys from unit 2(a) had collapsed onto unit 2(b) and damaged east portion of roof. 1- to 3-inch downward displacement of adjacent grade was observed on north and west sides (figs. 4, 5, and 6).
3	1925	I	Frame was standing, but several columns were fractured, spalled, and displaced horizontally. Portions of walls were collapsed and others had large fractures. 1- to 5-inch downward displacement of adjacent grade was observed on north and west sides (figs. 7 and 8).
4	1925	I	Frame was standing, but portions of walls were collapsed and others had large fractures and cracks.
5	1925	I	Frame was essentially intact. Walls had large fractures (fig. 9).
6	1925	I	Frame was standing, but several columns were fractured, spalled, and displaced horizontally. Portions of walls were collapsed and others had large fractures (fig. 10).
7	1925	I	Frame is essentially intact. Chimneys had collapsed onto roof. Ground floor had several 1/16-inch-wide cracks. Basement floor had several 1/8-inch-wide cracks and one 1 1/2-inch upward displacement. Exterior and basement walls had diagonal cracks. Interior walls had large fractures (fig. 11).
8	1925	I	Building was totally collapsed (fig. 12).
9	1925	I	Frame was partially collapsed and several remaining columns were fractured, spalled, and displaced horizontally. Portions of walls were collapsed and others had large fractures (fig. 13).
10	1925	I	Building was totally collapsed.
11(a)	1925	I	Frame was essentially intact. Chimneys were collapsed. Exterior walls had continuous horizontal cracks at floor- and rooflines. Portions of interior walls were collapsed and others had large fractures (fig. 14).
11(b)	1929	I	Frame was essentially intact. South exterior wall had continuous horizontal crack at roofline. North exterior wall had continuous horizontal crack at floorline. Interior walls had cracks from 1/8 inch to 1 inch in width (fig. 14).
12	1925	I	Frame was essentially intact. Upper portions of walls were collapsed and others had horizontal cracks.

Table 2.—Summary of inspection observations—Continued

Unit identification number	Year constructed	Structural classification type	Inspection observations
13	1925	III	Frame was standing, but portions of exterior walls were collapsed and others had large fractures with horizontal displacements (fig. 15).
14	1925	III	Frame was standing, but exterior walls had large fractures.
15	1925	III	Frame was standing, but exterior walls had large fractures, especially at window heads.
16	1925	III	Frame was standing, but exterior walls had large fractures with horizontal displacements.
17	1925	III	Frame was essentially intact, but some exterior walls had cracks up to 1/8 inch in width. Chimneys had cracks at roofline.
18	1925	III	Frame was essentially intact, but some exterior walls had cracks up to 1/8 inch in width. Chimney was fractured at roofline (fig. 16).
19	1925	III	Frame was standing, but portions of walls were collapsed and others had large fractures (fig. 17).
20	1925	Metal tank	Tank was essentially intact. Looking north, steel I-beam supports had rotated 90° counterclockwise. Tank was displaced about 4 inches in a west direction. Anchor bolts were deformed. Foundations were fractured and displaced 4 to 6 inches vertically (fig. 18).
23	1931	IV	Frame was essentially intact. Exterior walls had continuous horizontal cracks at floorline. 2-inch downward displacement of adjacent grade was observed on north side (fig. 19).
24	1927	IV	Frame was standing, but displaced horizontally. Walls had cracks and spalls, especially at openings.
25	1927	IV	Do.
26	1947	IV	Frame was essentially intact. Exterior walls had cracks and spalls, especially at openings. Wood frame canopy between units 26 and 29 was collapsed.
28	1928	III	Frame was standing, but majority of exterior walls were collapsed (fig. 20).
29	1930	II	Frame was essentially intact with no apparent damage. Wood frame canopy between units 26 and 29 was collapsed (fig. 21).
31	1939	III	Frame was standing, but walls had large fractures with horizontal displacements.
32	1939	III	Frame was standing, but west wall was collapsed and others had cracks.
33	1939	III	Frame was standing, but large portion of roof was collapsed and most of north wall was collapsed (fig. 22).
34	1932	V	Frame was essentially intact with no apparent damage.
35	1927	IV	Frame was standing, but displaced horizontally. Walls had cracks and spalls, especially at openings.

Table 2.—Summary of inspection observations—Continued

Unit identification number	Year constructed	Structural classification type	Inspection observations
40.....	1925...	6′×6′×6′ pit with reinforced concrete walls.	No apparent damage was observed.
41.....	1938...	II.....	Frame was essentially intact. Some walls had diagonal hairline cracks. Basement slab-on-grade had 1/16-inch-wide continuous crack running parallel to and 6 feet south of north exterior wall. 1- to 3-inch downward displacement of adjacent grade was observed on north and west sides (fig. 23).
42.....	1940...	III.....	Frame was essentially intact. Walls had diagonal cracks up to 1/8 inch in width.
43.....	1949...	II.....	Frame was essentially intact. Some walls had diagonal hairline cracks (figs. 24 and 25).
44.....	1949...	II.....	Frame was essentially intact. Some walls had diagonal hairline cracks. Chimney was collapsed (fig. 26).
45.....	1949...	II.....	Frame was essentially intact. South wall had a diagonal crack. North brick filler wall had several cracks and was bowed outward. Brick boiler walls had several large fractures with horizontal displacements (figs. 27 and 28).
47.....	1949...	Metal tank.	Tank was essentially intact. Slab-on-grade at anchor bolts had short hairline cracks. Water seepage was observed at the base (fig. 29).
49.....	1949...	Chimney with reinforced concrete wall.	Chimney was essentially intact. Wall had continuous horizontal hairline cracks at approximately 20 feet center to center, probably at construction joints. 2-inch downward displacement of adjacent grade was observed on north side (fig. 27).
50.....	1951...	II.....	Frame was essentially intact. South exterior wall had horizontal hairline cracks at top and bottom of piers between window openings. Interior basement walls had diagonal hairline cracks. 1- to 6-inch downward displacement of adjacent grade was observed on north and east sides (fig. 30).
52.....	1951...	II.....	Frame was essentially intact. No apparent damage was observed (fig. 31).
53.....	1950...	II.....	Frame was essentially intact. No apparent damage was observed. Exterior mechanical equipment (water filters) was displaced and pipes were broken (fig. 32).
54.....	1950...	II.....	Frame was essentially intact. No apparent damage was observed (fig. 33).
55.....	1950...	12-inch-deep tank with reinforced concrete walls.	No apparent damage was observed.
56.....		Slab-on-grade.	Do.
57.....		II.....	Structure was covered with debris and could not be inspected.
58.....	1957...	IV.....	Frame was essentially intact. No apparent damage was observed (fig. 34).
T-7.....	1947...	IV.....	Frame was essentially intact. No apparent damage was observed.
T-8.....	1947...	V.....	Do.
T-10.....	1947...	V.....	Do.
T-12.....	1948...	V.....	Do.
T-13.....	1947...	V.....	Do.

Figure 3.—Veterans Administration Hospital. Unit 1, remaining debris. North elevation of unit 43 in background.

Figure 4.—Veterans Administration Hospital. Unit 2(b). South elevation with remains of unit 2(a) at far right.

Figure 5.—Veterans Administration Hospital. Chimneys from unit 2(a) collapsed onto east end of unit 2(b) roof.

Figure 6.—Veterans Administration Hospital. Unit 2(b). Inside, looking up toward collapsed chimneys (see fig. 5).

igure 7.—Veterans Administration Hospital. Unit 3. East elevation.

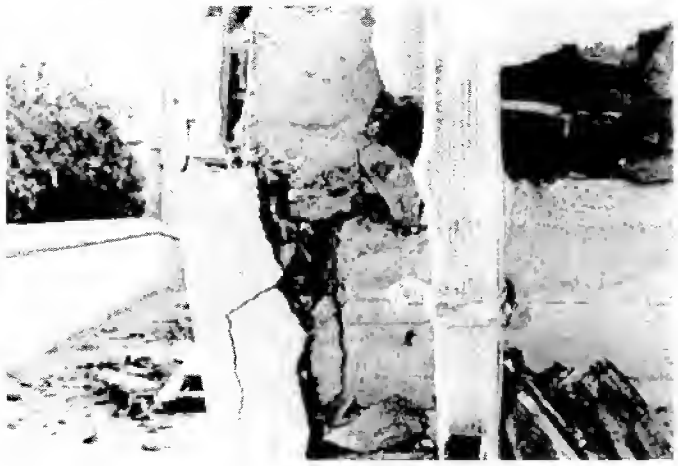

Figure 8.—Veterans Administration Hospital. Unit 3. Southeast corner column at first floor.

Figure 9.—Veterans Administration Hospital. Unit 5. East elevation.

Figure 10.—Veterans Administration Hospital. Unit 6. West elevation.

STRUCTURAL CLASSIFICATION OF BUILDINGS

In general, buildings usually are composed of two interrelated structural systems, whether intentionally designed or inadvertently constructed, namely; (1) a vertical load-carrying system that supports the actual weight or "dead load" of the building itself plus the anticipated weight or "live load" of occupants, equipment, furnishings, etc., and (2) a lateral force-resisting system that counteracts the impact of wind pressure and earthquake-generated ground motion.

A very common type of vertical load-carrying system, and the one used in all the hospital buildings, is a frame consisting of (1) horizontal elements such as slabs, sheathing, joists, trusses, beams, or girders, and (2) vertical components such as columns and walls.

A lateral force-resisting system contains (1) horizontal elements such as diaphragms, floors or roofs acting as diaphragms, chords (tension and compression members located at the diaphragm boundaries), struts or braces, and (2) vertical components such as shear walls and braces. Certain elements, such as walls, may function concurrently to resist lateral forces and carry vertical loads.

Supplementary to both the vertical load-carrying and lateral force-resisting systems is the foundation system. Throughout all the hospital buildings one basic foundation system was employed, although the allowable soil bearing design pressure varied from building to building. Columns and walls are supported on isolated and continuous footings, respectively.

There are several possible options available for combining the various vertical load-carrying with lateral force-resisting systems, and elements within the different systems may be constructed from a variety of materials. The hospital buildings are classified according to like materials used in constructing the variously combined structural systems, as set forth in table 1, without regard to building size, height, occupancy classification, or whether any particular lateral force-resisting system listed was intentionally designed as such. Also, only the primary elements of a particular structural system are identified. If, for example, a building frame constructed predominantly of concrete has a pitched wood frame roof built above a concrete diaphragm, the wood frame is considered as a secondary element and therefore is not mentioned.

Figure 11.—Veterans Administration Hospital. Unit 7. North elevation of north wing.

Figure 12.—Veterans Administration Hospital. Unit 8. East elevation

Figure 13.—Veterans Administration Hospital. Unit 9. North elevation.

Figure 14.—Veterans Administration Hospital. Unit 11. South elevation.

Figure 17.—Veterans Administration Hospital. Unit 19. South elevation.

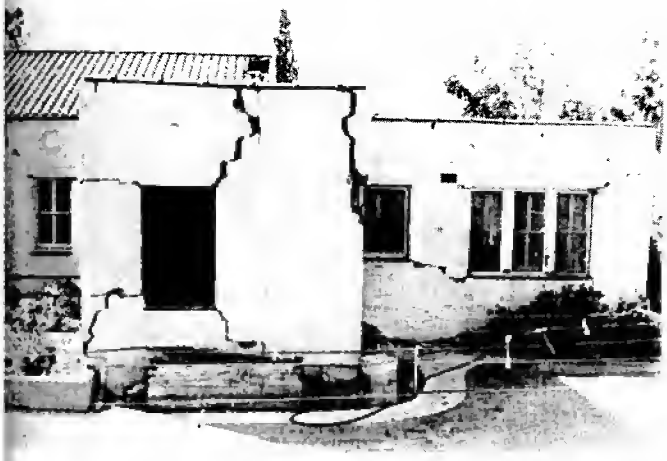

Figure 15.—Veterans Administration Hospital. Unit 13. North elevation.

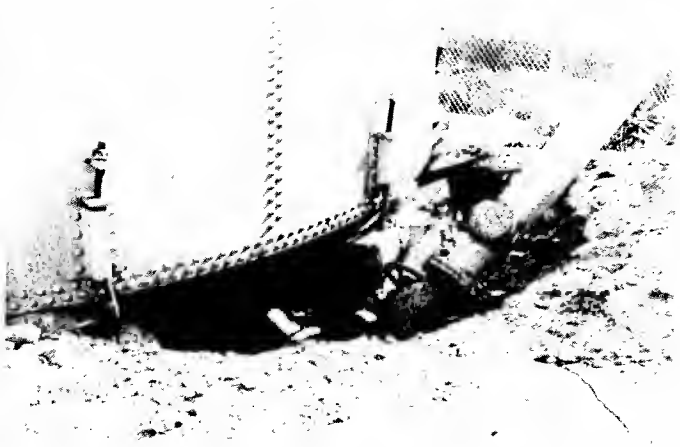

Figure 18.—Veterans Administration Hospital. Unit 20. West elevation.

Figure 16.—Veterans Administration Hospital. Unit 18. North elevation.

Figure 19.—Veterans Administration Hospital. Unit 23. East elevation.

Figure 20.—Veterans Administration Hospital. Unit 28. West elevation.

Figure 23.—Veterans Administration Hospital. Unit 41. South elevation with remaining debris of unit 2(a) in foreground.

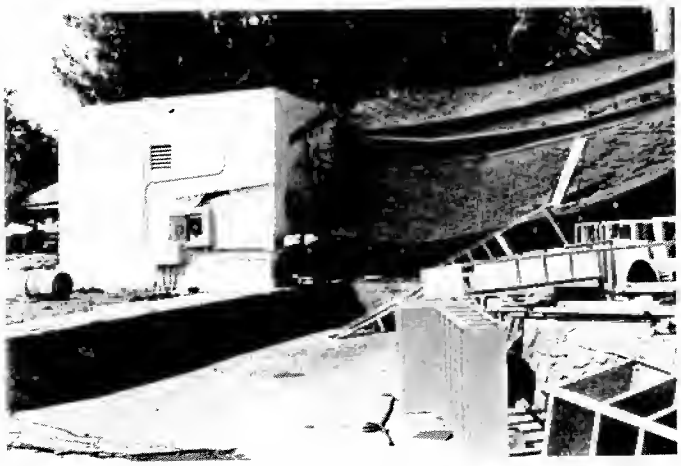

Figure 21.—Veterans Administration Hospital. Unit 29. East elevation, showing collapsed canopy between units 29 and 26.

Figure 24.—Veterans Administration Hospital. Unit 43. East elevation.

Figure 22.—Veterans Administration Hospital. Unit 33. North elevation.

Figure 25.—Veterans Administration Hospital. Unit 43. South elevation.

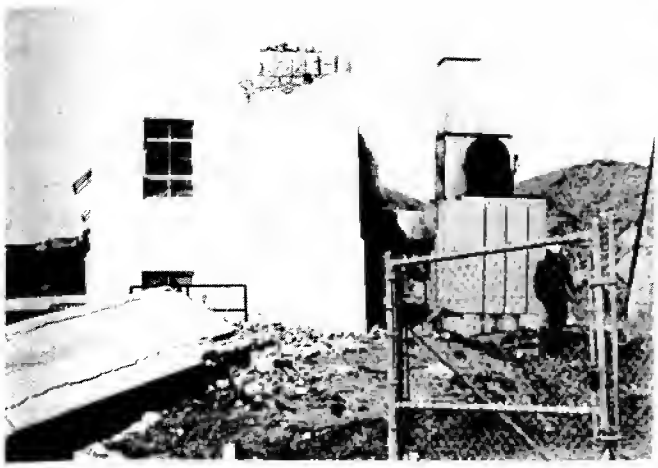

Figure 26.—Veterans Administration Hospital. Unit 44. East elevation.

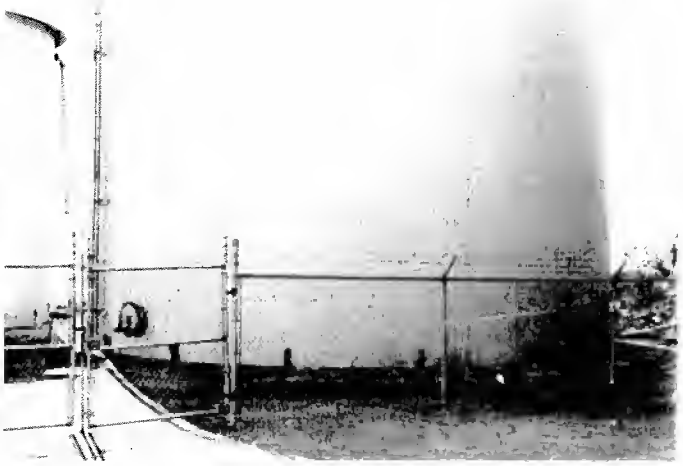

Figure 29.—Veterans Administration Hospital. Unit 47. North elevation.

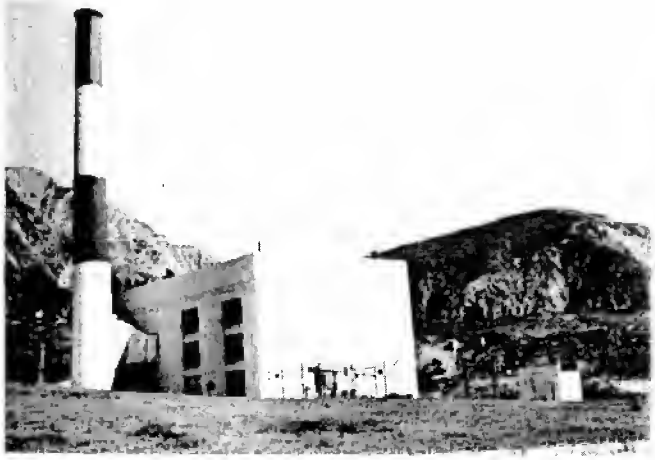

Figure 27.—Veterans Administration Hospital. Units 45 and 49. South elevation.

Figure 30.—Veterans Administration Hospital. Unit 50. South elevation.

Figure 28.—Veterans Administration Hospital. Unit 45. North elevation.

Figure 31.—Veterans Administration Hospital. Unit 52. West elevation.

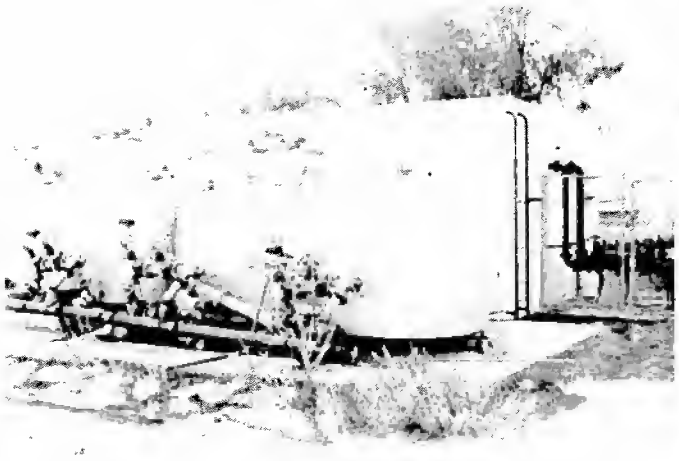

Figure 32.—Veterans Administration Hospital. Unit 53. East elevation.

Figure 33.—Veterans Administration Hospital. Unit 54. West elevation.

Figure 34.—Veterans Administration Hospital. Unit 58. North elevation.

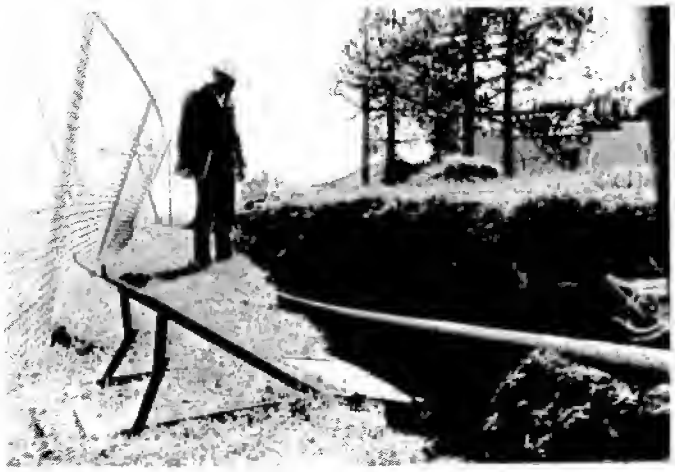

Figure 35.—Veterans Administration Hospital. Earth slippage along hilltop north of units 8 and 10.

FEDERAL SEISMIC-RESISTIVE DESIGN REQUIREMENTS

Federal building construction is not subject to the jurisdiction of local city or county building ordinances. Some Government agencies, such as the Department of the Navy, Bureau of Yards and Docks (Navdocks), have prepared technical design manuals for use on agency projects. Others, including the Veterans Administration, have maintained a policy of accepting local building code criteria for building design and construction rather than adopting any particular code for nationwide use.

EVALUATION AND CONCLUSIONS

Although some hillside earth slippage was observed (fig. 35), the building failures were precipitated by intense areal ground motion rather than localized earth faulting or permanent ground movements. An examination of the data in table 2 reveals that, for the most part, the 26 buildings and additions constructed prior to 1933 sustained the greatest structural damage. Four of these buildings totally collapsed during the initial moments of the main shock, and the remainder, with the exception of unit 29 (paint and oil storage building, fig. 21) and unit 34 (greenhouse), are in various stages of deterioration. Of the two ancillary structures built prior to 1933, unit 20 (water tank, fig. 18) incurred substantial damage to the support beams and foundations, but unit 40 (automatic valve chamber) experienced no observable structural damage.

Only four of the 21 buildings and additions built subsequent to 1933—units 31, 32, 33 (three- and four-car garages) and unit 42 (pumphouse, not in use)—exhibited the same degree of visible impairment as those previously constructed; however, unit 57 (transformer vault, attached to unit 1) may have been damaged from the collapse of unit 1, but was covered with debris and inaccessible for inspection.

Samples of reinforcing steel and concrete from various structural elements of units 1 and 2 were extracted and tested. The laboratory test results indicated that the construction materials conformed to the requirements of the contract documents.

The structures built prior to 1933 did not have any lateral seismic force-resisting elements incorporated into their design. Unfortunately, at the time these buildings were constructed there were no building code seismic-resistive design regulations. Although in some of the buildings the hollow clay tile walls prevented initial collapse of the structure, these walls were designed primarily to function as architectural interior and exterior partitions, not as lateral-resisting shear elements. Hollow clay tile walls are extremely brittle and tend to disintegrate under the shock of impact loads, such as those generated by earthquakes.

The presence of lateral force-resisting systems in buildings constructed subsequent to 1933 indicates that these structures were designed and constructed in compliance with historically applicable building codes. This is substantiated further by the performance of these buildings during the earthquake of February 9.

Units 31, 32, 33 (garages built in 1939), and unit 42 (pumphouse built in 1940), all relatively minor structures, probably were designed to complement the already established architectural style.